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An Impact of Life Cycle Sustainability on the Shareholder Value of a Firm: An Analysis of Interaction Effects

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Abstract

The present paper studies the impact of life cycle sustainability of goods and services on shareholder value of the firm and further this study extends to analyse the role of interaction effects of variables on shareholder value as measured by Tobin's q. For this purpose, 73 companies listed on Bombay Stock Exchange have been studied. Content analysis methodology has been employed to analyse the content of Business Responsibility Report given in annual reports. Further regression analysis has been conducted to study the impact of sustainable supply chain on Tobin's q and to analyse the interaction effects. The results of the study indicate that sustainable activities related to pre-operations and society has significant positive impact on shareholder value of the firm. Further the results of interaction effects of the variables also state that interaction has significant impact on the shareholder value and the impact depends upon the nature of the control variable with which the explanatory variables interact. It has been concluded that companies must practice sustainability in supply chain in order to enjoy high shareholder value. Thus, the study bestows to the existing literature on sustainability by expanding it to the developing country like India.

Keywords: Life Cycle Sustainability, Shareholder Value, Tobin's q, India, Interaction Effects, Supply Chain

Introduction

Over the years, the expectations for sustainability have increased. Kolk (2004) specifically states that sustainability reporting initially was a topic of research for academia and government but slowly it has shifted to corporations as well. Some corporations have already taken initiatives and other corporations are taking initiatives to implement the effective sustainable development. Jose and Lee (2007) emphasise that expectations from the performance of the companies has changed and there is a call for environmental sustainability. Now-a-days, sustainability is mandatory for corporations because of various reasons like stakeholder involvement, interference of regulatory bodies, social obligation or it can be competitive advantage. Kolk (2004) has pointed out several sustainability-related benefits that a corporation enjoys like increased efficiency in resource utilisation, high investment return and improvement in corporate image. Life cycle sustainability means sustained supply chain procedures, manufacturing procedures and selling procedures. Albino, Balice, and Dangelico (2009) explain green supply chain as the procedures that evaluate the supply chain of a company in environmental-friendly issue.

The paper focuses on the role of life cycle sustainability of goods and services on the financial performance of the company. This paper peculiarly centres on the top 100 listed companies in India on Bombay Stock Exchange. Jose and Lee (2007) state that regulatory authorities are putting pressure on corporations to become responsible for environment. In 2011, Ministry of Corporate Affairs of India gave National Voluntary Guidelines on the issues regarding environment, society and governance. Security Exchange Board of India made mandatory for top 100 listed companies to report sustainability in Business Responsibility Report in their annual reports in the prescribed format. One of the principles, i.e., life cycle sustainability principles present in Business Responsibility Report has been studied in this paper. We test whether practising life cycle sustainability practices affects the financial performance of the company. Supply chain has been evaluated with the help of sustainable procedures to deal with pre-operation activities, operation activities, post-operation activities and activities related to society.

Review of Literature

Plethora of regression-based research has been conducted to determine the role of sustainability on financial performance. As regard the sustainability some researchers say either it has positive influence on firm performance (Dowell, Hart, & Yeung, 2000; King & Lenox, 2001; Konar & Cohen, 2001; Lo & Sheu, 2007; Wagner, 2010) or it has negative influence on firm performance in the first few years (López, Garcia, & Rodriguez, 2007). Generally regression-based studies include multivariate analysis of multiple independent variables and one dependent variable. Regression analysis not only enables us to access the variance explained by the independent variables but also helps to analyse the interaction effect of explanatory variables and control variables on dependent variable. In relation to this paper Tobin's q has been used as dependent variable. The papers of particular relevance that have used Tobin's q have been reviewed in context to this paper.

In the first study Konar and Cohen (2001) examine the extent to which environmental performance is valued in the market. Based upon sample size of 321 firms from S&P 500 for the year 1989, using Tobin's q as dependent variable and Toxic Release Inventory (TRI) as independent variable. They found that by controlling other explanatory variables like R&D expenditure, industry concentration, market share, firm growth rates, firm size and advertising expenditure; there is negative impact of low environmental performance on Tobin's q. All the control variables expect firm size are positively related to Tobin's q. Thus it is concluded that low environmental performance has negative impact on value of the firm in market, i.e., low environmental performance means lower value of the firm. A reduction of 10% in TRI, increases the value of the firm by $34 million.

In the second study, King and Lenox (2001) study the connection of TRI emission with financial performance of the company by using Tobin's q as dependent variable. Various variables have been controlled such as annual growth, firm size, R&D intensity and capital intensity to study the impact of TRI emission. To explore the study, 652 US manufacturing companies from the year 1987 to 1996 have undertaken. It has been found that there is negative association between TRI emissions and economic performance. Lower TRI emissions mean higher financial performance.

In third study, Lo and Shang (2007) using Tobin's q as dependent variable examine whether corporate sustainability has impact on financial performance of the firm. Their study is based on sample of large non-financial US-based firms from the year 1999 to 2002. Sustainability dummy is independent variable. Controlling variables like firm size, access to financial market, leverage, profitability, sales growth, investment growth, industrial diversification, credit quality and industry effect, a positive association is determined between sustainability dummy and Tobin's q. Their study also addressed the solid interaction effect between sustainability and sales growth on Tobin's q where as other interactions between rest of the control variables and sustainability dummy are not significant.

Finally in fourth study, Wagner (2010) used Tobin's q as a measure of economic performance, i.e., dependent variable has been used in the study. Several control and explanatory variables are used to explain the role of sustainability performance on financial performance of the company. Corporate sustainability performance index is main explanatory variable. In addition to the independent and dependent variable, many other variables like firm age, firm size, R&D intensity, advertising intensity and sales growth have been used as control variable. Based on sample size of 358 US firms from the year 1992 to 2003 it has been concluded that sustainability performance has positive impact on economic performance of the company. Further Wagner (2010) studied the interaction effect of R&D and advertising intensity with corporate social and corporate environmental performance. It is observed that interaction effect of corporate social performance and advertising intensity has positive effect on corporate performance of the company.

In line with the previous regression-based studies on analysing the role of sustainability and financial performance of the company, the present study is based on determining the role of life cycle sustainability of goods and services on Tobin's q and to analyse the interaction effects. However issues like Toxic Release Inventory emissions, sustainability performance index, sustainability dummy has been used as independent variable but issue related to life cycle sustainability has not been used previously. In the present paper the life cycle sustainability issue has been addressed.

Research Methodology

The role of life cycle sustainability of goods and services on shareholder value of the firm has been analysed by using the methodology that explores the activities of

supply chain process. It has been done in two parts. First part is concerned with the content analysis of business responsibility reports. The set of top 100 companies from BT 500 list in the year 2014 has been selected. Among these 100 companies only 73 companies provided the information regarding life cycle sustainability. Annual reports act as raw material for sustainability studies (Guthrie & Abeysekera, 2006). Business Responsibility Reports for the year 2014 has been content analysed for the companies listed on BSE. Data has been collected from prowess, ace equity software and annual reports.

Second part is concerned with regression analysis to explore the supply chain activities that increases shareholder value. Shareholder Value of the firm has been measured using Tobin's q. Tobin's q is chosen as dependent variable and is measured as the natural log of the ratio between market value of firm's assets and its replacement cost. The main independent variable is life cycle sustainability of goods and services. The independent variable is operationalised by studying the existing literature. Jose and Lee (2007) have used variables like suppliers, community, customers to access the environment management of the company. Sustainable development of the product is indicator of sustainability of company (Jose & Lee, 2007). Life cycle sustainability of goods and services has been evaluated by content analysing the activities of supply chain process. These are pre-operation activities (activities related to sustainable sourcing), operation activities (activities related to sustainable production, resource utilisation), post-operation activities (activities related to sustainable recycling, delivering) and society (activities related to procure goods from local and small producers). Dummy variables for these four activities have been used. 1 if the company provides information regarding the activity in the BRR report otherwise 0 if it does not report anything.

Apart from four explanatory independent variables (pre-operations, operations, post-operations and society) and one dependent variable (Tobin's q); additional variables selected on the basis of existing literature have also been included. These include profitability (measured as return on assets), size of the firm (measured as natural log of total assets), leverage (measured as debt-equity ratio), sales growth (measured as natural log of sales change) and investment growth (measured as natural log of ratio of capital expenditure to sales). Further the interactions of explanatory variables with control variables that are positively related to Tobin's q have been introduced and models have been developed to analyse the interaction effect on Tobin's q using multiple regression.

Results and Discussion

Table 1: Definitions of Independent Variables.

Control variables	Definition
Size of the firm	Measured as natural log of total assets
Profitability	Measured as Return on Investment (ROA)
Leverage	Measured as debt-equity ratio
Sales growth	Measured as natural log of sales change
Investment growth	Measured as natural log of ratio of capital expenditure to sales
Explanatory variables	
Pre-operations	Sustainable sourcing = 1 and otherwise = 0
Operations	Sustainable manufacturing, resource utilisation = 1 and otherwise = 0
Post-operations	Recycling, reusing, sustainable delivering = 1 and otherwise = 0
Society	Souring from local and small producers = 1 and otherwise = 0

Table 1 shows the base model that includes all the control variables (profitability, size, leverage, sales growth and investment growth); explanatory variables (pre-operations, operations, post-operations and society). It has been found that size has significant negative coefficient which signifies that size of the firm as measured by natural log of total assets have negative impact on Tobin's q (Dowell et al., 2000; King & Lenox, 2001; Konar & Cohen, 2001; Lo & Sheu, 2007; López et al., 2007; Wagner, 2010). Another control variable profitability as measured by return on assets has significant positive impact on Tobin's q (Lo & Sheu, 2007). It implies that as the return on assets increases, the shareholder value of the firm also increases. Rest all the control variables are consistent with the existing literature and have insignificant negative impact on Tobin's q. So far as explanatory variables are concerned, amongst four variables only society has significant positive coefficient. Sustainable activities related to the society that are practiced by the companies have positive impact on Tobin's q. Rest three explanatory variables have insignificant impact, meaning thereby they have lesser influence on shareholder value of the firm.

Table 2: Base Model

Independent variables Control variables	Std. Coefficient	P Value
Size	-0.349	0.000
ROA	0.58	0.000

Independent variables Control variables	Std. Coefficient	P Value
D/E ratio	-0.111	0.097
Log sales growth	-0.95	0.075
Log investment	-0.05	0.408
Explanatory variables		
Pre-operations	0.006	0.913
Operations	-0.052	0.322
Post-operations	-0.06	0.256
Society	0.145	0.01
F values, p value	42.14	0.00
R2	0.86	
Adjusted R2	0.84	

Table 2 shows the models that have been developed on the basis of interaction effect of explanatory variables (statistically insignificant variables with Tobin's q) with control variables (statistically significant variables related with Tobin's q). Interaction effect has been studied based on the extant literature (Wagner, 2010). Interaction variables (size × pre-operation, ROA × pre-operation, size × operation, ROA × operation, size × post-operation, ROA × post-operation) have been introduced as explanatory variables one by one in each model to study the impact on Tobin's q. In the first model two interacting variables are introduced. It is clear from the 1st model that interaction variable, size × pre-operations and ROA × operations do not have significant impact on Tobin's q. Amongst the other control and explanatory variables only ROA and society respectively have statistically significant impact on Tobin's q.

Table 3: Various Models Showing Interaction Effects Result

Independent variables	Model 1		Model 2		Model 3		Model 4	
Control variables	std. Coefficient	P value	std. Coefficient	P value	std. Coefficient	P value	std. Coefficient	P value
Size	-0.417	0.000	-0.418	0.000	-0.486	0.000	-	-
ROA	0.730	0.000	0.764	0.000	-	-	-	-
Explanatory variables								
Pre-Operations	-	-	-	-	-	-	0.152	0.033
Operations	-0.041	0.461	-0.038	0.496	0.025	0.702	-	-
Post-Operations	-0.516	0.608	-	-	-	-	-	-
Society	0.131	0.014	0.133	0.014	0.119	0.060	0.159	0.028
Size x Pre-Operations	0.128	0.072	0.127	0.076	-0.050	0.501	-	-
ROA x Pre-Operations	-0.177	0.254	-0.147	0.256	0.383	0.000	-	-
Size x Operations	-	-	-	-	-	-	-0.434	0.000
ROA x Operations	-	-	-	-	-	-	0.596	0.000
Size x Post-Operations	-	-	0.011	0.899	-0.120	0.180	-0.251	0.008
ROA x Post-Operations	-	-	-0.046	0.628	0.200	0.046	0.208	0.067
F values, p value	49.45	0.000	42.65	0.000	31.75	0.000	25.42	0.000
R^2	0.84		0.84		0.78		0.70	
Adjusted R^2	0.83		0.82		0.75		0.67	

In the second model, two control variables (size and ROA), two explanatory (operations and society) and four interacting variables (size × pre-operations, ROA × pre-operations, size × post-operations and ROA × post-operations) have been introduced. It has seen that interaction variables have no significant impact on Tobin's q. Further in the third model only one control variable i.e. size has been introduced and it is seen that interaction effect of significantly positive control variable (ROA) with pre-operation and post-operation activities has significant positive coefficient, meaning thereby they have high positive impact on Tobin's q. Pre-operation activities includes the suppliers as well. Pre-operations are showing significant positive result thereby meaning that supplier selection is an important element in increasing the financial position of the company (Morali & Searcy, 2013).

Further in the fourth model, four interaction variables (size × post-operations, ROA × post-operations, size

× operations and ROA × operations) along with two explanatory variables (pre-operations and society) have been introduced. It has been found that interaction effect of size of the firm with post-operation and operation activities have negative significant coefficient, thereby showing that they have negative impact on Tobin's q. As consistent with previous literature size has negative impact on Tobin's q (Dowell et al., 2000; King & Lenox 2001; Konar & Cohen, 2001; Lo & Sheu, 2007; López et al., 2007; Wagner, 2010). Therefore it could be the reason, that interaction effect of size with other explanatory variables has negative impact on Tobin's q. On the other side interaction of ROA with explanatory variables have significant positive impact on Tobin's q due to the reason that that ROA has positive impact on shareholder value of the firm (Lo & Sheu, 2007).

Conclusion and Implications

From the above results and discussion it can be concluded that shareholder value of the firm is more in the companies that practice sustainability in activities that are related to society and pre-operation part of supply chain. Society related activities include procurement of goods and services from local and small producers, giving employment to weaker section, encouraging women workers etc. Practicing sustainability in sourcing of raw material also has positive impact on shareholder value. The results have concluded that society and pre-operation activities has positive impact on shareholder value irrespective of the size and profitability of the company. Higher the sustainability practice in society and pre-operation related activities more is the shareholder value of the firm. Another interesting finding is that while determining the financial performance, life cycle sustainability is influenced by size and profitability of the firm. The results of interaction effect conclude that companies having higher profitability and practicing sustainability in operations and post-operations enjoy higher shareholder value. Whereas companies having larger size and practicing sustainability in operations and post-operations enjoy lesser shareholder value.

The results of the study offer implications for the companies. First, managers of the all companies should focus on society related sustainability activities in order to enjoy shareholder value because sustainability in society increases shareholder value irrespective of size and profitability of the company. Second, companies must source material from suppliers that are certified to be complaint with environment standards so as to increase their company's shareholder value. Third, companies with higher Return on Assets must focus on operation activities and post-operation activities in order to enjoy better financial performance.

The study also adds the value to the existing literature by studying the sustainability of supply chain activities. In fact it is one of the initial studies that have focused on the sustainability of supply chain and studied the interaction effects of supply chain activities with the other variables on shareholder value. The study assists managers in creating shareholder value for the firm in the developing economy like India by focusing on the particular activities.

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